



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/683,836 | 02/21/2002 | James A. Bruce | BUR920010049 | 9685 |

7590 01/11/2007
GREENBLUM & BERNSTEIN, P.L.C.
1950 ROLAND CLARKE PLACE
RESTON, VA 20191

| |
|----------|
| EXAMINER |
|----------|

STREGE, JOHN B

| | |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2624

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
|--|------------|---------------|
| 3 MONTHS | 01/11/2007 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

09/683,836

Applicant(s)

BRUCE ET AL.

Examiner

John B. Strege

Art Unit

2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 October 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 and 36-46 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 and 36-46 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 March 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Response to Amendment

The amendment received 10/30/06 has been entered in full.

Response to Arguments

Applicant's arguments filed 10/30/06 have been fully considered but they are not persuasive. Specifically the Applicant argues that Cai does not teach or suggest determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. The Examiner respectfully disagrees. Specifically as noted in the prior office action Cai discloses that the determining of a final disposition of the component can be done by applying different acceptance rules to the critical defects and the non-critical defects (col. 9 lines 48-50). Although Cai discloses that this is computationally intensive to apply different rules, the Examiner does not consider this as teaching away from using different rules since it implies that it can be done. Teaching away would only be if Cai were to disclose that multiple rules could not be used, which is not the case. Cai further states that any standard pattern recognition tools can be used to analyze the physical masks (col. 14 lines 49-61). Thus using different rules is not excluded and Cai does not teach away from using different rules.

The Applicant further argues that Cai does not disclose or imply that one rule is applied to critical defects while a different rule is applied to non-critical defects. However this is a new limitation added in claims 38, 40, and 42 and is not reflected in the prior claims. Thus these limitations will be addressed in the rejection below.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-6,8-20,36-37,39,41 and 43-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. USPN 6,757,645 (hereinafter "Chang") in view of Cai et al. USPN 6,873,720 (hereinafter "Cai").

Chang discloses a method of evaluating the effect of defects on components in a semiconductor manufacturing process (col. 1 lines 19-22), comprising the steps of inspecting a component for defects using an inspection tool (400, col. 9 lines 60, see at least lines 6-10 of the abstract); recording defect inspection data from the inspection tool (storage device 447, col. 10 lines 10-24, col. 11 lines 43-57); accessing design data from a design data repository corresponding to the component being inspected (910 of figure 9, note that col. 20 lines 26-30 disclose that the system of figure 9 can operate the same as the system for figure 4); modifying said design data for the component according to said defect inspection data (col. 20 lines 60-67 discloses that a simulation of the wafer print of the portion of the design mask which corresponds to the portion represented by the defect area image is simulated, simulation is a modification); analyzing said modified design data (col. 21 lines 9-34 discloses that the simulated image of the design data is compared to the simulated image of the physical mask, this

Art Unit: 2624

is an analysis of the modified design data). Finally Chang discloses classifying (characterizing) the defects (col. 11 lines 47-50).

Chang does not explicitly disclose classifying the defects into critical and non-critical defects based on the analyzing and determine a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. It is noted however that Chang does disclose determining the severity of the characterized defects to accept, reject, or repair the mask, see figure 11.

Cai incorporates by reference the application (now a patent) of Chang (col. 2 lines 47-51). Cai recites that the problem with Chang is that a customer must review the information to make a determination regarding the appropriate action to take such as repairing the mask or fabricating a new mask, and this leads to human error (col. 3 lines 25-29). To improve on this Cai discloses a system for providing defect printability analysis for an integrated circuit mask which corrects this problem. Cai discloses identifying critical and non-critical regions of the integrated circuit (514, col. 14 lines 49-61, and col. 8 lines 45-67) and using this information in addition to the simulated data in the defect printability analysis generator 515 to characterize (classify) the defects as substantial or unsubstantial (critical or non-critical, col. 9 lines 3-8). Finally Cai discloses that the determining a final disposition of the component can be done by applying different acceptance rules to the critical defects and the non-critical defects (col. 9 lines 48-50). It is noted that Cai discloses that this is computationally intensive to apply different rules, however it shows that it is well known that this could be done.

Chang and Cai are analogous art because Chang incorporates the Cai reference.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Chang and Cai to classify the defects into critical and non-critical based on the analyzing and determine a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. The motivation would be to reduce human error by making the process automatic. Thus it would have been obvious to one of ordinary skill in the art to combine Chang and Cai to obtain the invention as specified in claim 1.

Regarding claim 2, as discussed Cai discloses that the invention is for mask inspection.

Regarding claims 3, and 6 Chang discloses that the mask comprises opaque areas and clear areas (col. 2 lines 20-38) and that a defect printing depends greatly on its location, size, and transmission/reflection characteristics (col. 4 lines 10-29). Thus it would be obvious to include if the defect is clear or opaque with the defect data to determine the importance of that part of the mask.

Regarding claims 4-5, Cai discloses that the final disposition of the mask being inspected includes scrapping the mask, repairing the mask, or accepting the mask and determining whether a defect is likely to cause failure (paragraph bridging cols. 17-18).

Regarding claim 8, as discussed Chang discloses a design layout database but does not explicitly disclose that the database is suitable for storage of large files.

However it would be obvious to use a database suitable for storage of large files and

therefore the examiner declares official notice. The motivation for using a database suitable for storage of large files is that it could contain information for different types of masks.

Regarding claim 9, Chang discloses that the design image simulator 960 simulates a defect shape for the mask layer being inspected corresponding to defects from said defect detection processor 925.

Regarding claim 10, Chang discloses that different mask layers are used to produce the semiconductor device with various layers and shows an effective method for inspecting a layer of the mask. Chang does not explicitly disclose analyzing both intra-level and inter-level problems of the mask layer, but it would be obvious to do so in order to accurately determine the defects of the mask which are important with respect to the desired representation of the photo-resist material etched into the silicon (col. 3 lines 39-61).

Claim 11 is similar to claim 1, except claim 11 discloses that a mask region is inspected. As discussed above both Chang and Cai are for inspecting a mask region.

Claim 12-14 are similarly analyzed as claim 4.

Regarding claim 15, Cai discloses using heuristic rules to determine if the defect will be resolved onto the wafer (col. 13 lines 25-67).

Claims 16-18 are similar to claims 11-13 except claims 16-18 are system claims thus they are similarly analyzed and rejected.

Claims 19-20 are similar to claims 11-12 except claims 19-20 are computer readable medium claims, thus they are similarly analyzed and rejected.

Claim 36 is similar to claim 1 with the main difference being that the shapes are generated representing the defects. A defect inherently has a shape. As Chang and Cai disclose simulating the defect on the mask as it would appear, this means that the shape of the defect on the mask will be used to generate a shape that will represent how the defect would look. Thus claim 36 is similarly analyzed to claim 1.

Regarding claims 37,39, and 41 Cai discloses that the critical and non-critical portions of the mask are determined and if the defects are in the region (col. 9 lines 3-11).

The limitations of claims 43 and 46 have already been addressed in the rejection of the more defined claim 1. Thus the same arguments that were used for the rejection of claim 1 apply equally to the rejection of claim 43 and only limitations that were not discussed above will be discussed here. Claim 43 has the additional limitation of generating a shape representing the defect. Chang discloses this as seen in figure 4 numeral 442. Furthermore as discussed Chang discloses applying a plurality of rules thus it is inherent that a first rule and a second rule are used.

Regarding claims 44-45, Cai discloses that each defect can be analyzed according to its location relative to neighboring features (col. 9 lines 12-44).

3. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. USPN 6,757,645 (hereinafter "Chang") in view of Cai et al. USPN 6,873,720

Art Unit: 2624

(hereinafter "Cai") and further in view of Mansfield et al. USPN 5,965,306 (hereinafter "Mansfield").

Chang discloses creating a simulated wafer image of a defect 970 and merging the image into a simulated wafer image (as seen by 2030 of figure 20. Chang does not explicitly disclose that the defect inspection data comprises intensity contour plots.

It is well known in the art of mask inspection to use the inspection tool AIMS which produces intensity contour plots.

Mansfield discloses that a standard mask inspection/repair process entails incorporating the defect size criterion of the device manufacture into the inspection tool and that advanced mask maker may utilize the AIMS tool to facilitate this process (col. 4 lines 30-46).

Cai, Mansfield and Chang are all analogous art because they are from the same field of endeavor of mask inspection.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Cai, Mansfield and Chang to use the AIMS inspection tool thus producing intensity contour plots in order to facilitate the inspection process. Thus it would have been obvious to combine Cai, Aloni, Mansfield and Chang to obtain the invention of claim 7.

4. Claims 38,40, and 42 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. USPN 6,757,645 (hereinafter "Chang") in view of Cai et al. USPN

6,873,720 (hereinafter "Cai") and further in view of Shibata et al. UPSN 6,850,320 (hereinafter "Shibata").

Regarding claims 38,40, and 42, Chang nor Cai explicitly disclose that the applying different acceptance rules comprises: applying a first acceptance rule to the defects located in critical portions of the component; and applying a second acceptance rule, that is looser than the first acceptance rule to the defects located outside the critical portions of the component.

Shibata discloses a method for inspecting defects wherein inspection regions are defined base on criticalities and detection sensitivities can be set for each of these inspection sensitivities (see abstract and col. 1 lines 55-60). Furthermore Shibata discloses that degrees of criticality can vary depending on factors such as the different pattern design rules (col. 4 lines 52-60). This is beneficial because it leads to catching the killer defects and can contribute to the product yield (col. 1 lines 38-47).

Chang, Cai, and Shibata are analogous art because they are all from the same field of endeavor of defect inspection.

At the time of the invention it would have been obvious to one of ordinary skill in the art to combine Chang, Cai, and Shibata to apply different acceptance rules based on the criticality of the portions. The motivation for doing so would be to contribute to the product yield by insuring that the critical killer defects are inspected more thoroughly. Thus it would have been obvious to one of ordinary skill in the art to combine Chang, Cai and Shibata to obtain the invention as specified in claims 38,40, and 42.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John B. Strege whose telephone number is (571) 272-7457. The examiner can normally be reached on Monday-Friday between the hours of 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2624

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JS



JINGGE WU
SUPERVISORY PATENT EXAMINER